

BEFORE THE AUCKLAND UNITARY PLAN INDEPENDENT HEARINGS PANEL

IN THE MATTER of the Resource Management Act
1991 and the Local Government
(Auckland Transitional Provisions)
Act 2010

AND

IN THE MATTER of Topic 081b Rezoning and Precincts

STATEMENT OF REBUTTAL EVIDENCE OF SAMUEL CASEY MORGAN
(COASTAL PROCESSES) ON BEHALF OF LONG BAY OKURA GREAT PARK
SOCIETY INCORPORATED

24 MARCH 2016

1 INTRODUCTION

- 1.1 My full name is Samuel Casey Morgan. I hold a Master of Science degree (Hons) in Marine Science, specialising in the geosciences, from the University of Auckland.
- 1.2 I have approximately twelve years' experience in the field of Coastal Science and Management. I am currently a Senior Coastal Project Manager at AR & Associates Ltd, a civil and environmental engineering consulting firm based in Takapuna, Auckland.
- 1.3 In 2008 I started at the Rodney District Council in an operational role undertaking the maintenance and development of coastal assets within the district. Previous to this I was involved in research and teaching at the University of Auckland and University of Wollongong, as well as research at the Elkhorn Slough Estuarine Research Centre in California.
- 1.4 From 2009 to 2011 I worked in Davis Coastal Consultants on a range of coastal management and engineering projects. Subsequent to that I was employed by Auckland Council as a Senior Coastal Scientist, until January 2016, providing advice across Auckland Council in coastal science and management issues.
- 1.5 Much of my academic focus was on the relationship between coastal geomorphology and longer term habitat trends. My master's thesis involved an investigation into the late Holocene development and habitat changes in the Matapouri Estuarine system.
- 1.6 Through my professional career I have applied this thinking to observed changes at the Elkhorn Slough in California and mangrove management issues around the Auckland region.
- 1.7 In preparing this rebuttal statement I have read the evidence prepared in relation to Okura by the following parties:

Okura Holdings Ltd

- Dr. Malcolm Green (Sediment transportation and deposition)
 - Dr. Andrew Loher and Dr. Michael Townsend (Marine Ecology)
 - Dr. Sharon De Luca (Marine Ecology)
- 1.8 I have read and understand the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and agree to comply with it. This evidence is within my area of expertise, except where I state otherwise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this statement of evidence.

2 SCOPE AND BACKGROUND

- 2.1 The focus of my rebuttal evidence is on sediment transportation and deposition within the Okura Estuary and Karepiro Bay, of material generated by the Okura Holdings Ltd (OHL) proposal.
- 2.2 I have not considered the fate of zinc and copper contaminants that enter the system, as this is outside my area of expertise.
- 2.3 The Okura Estuary is part of the Long Bay-Okura Marine Reserve, and has an SEA Marine 1 classification, which clearly demonstrates the sensitivity of this receiving environment. This means that it is of high priority to protect these environments to increased sedimentation and other effects that result from urbanisation.
- 2.4 The Okura Estuary is considered a drowned river valley characterised by large areas of intertidal flats and a single main tidal channel.
- 2.5 Swales et al., 2008 discussed historic and current rates of sedimentation within Okura Estuary and Karepiro Bay. The Okura Estuary system is thought to have reached an advanced stage of infilling, and sediment accumulation rates in the upper estuary are estimated to be between 3-6mm yr⁻¹.
- 2.6 Sedimentation rates within the intertidal flats of Karepiro Bay have been estimated to be between 3-5.2mm yr⁻¹.
- 2.7 As described in his evidence Dr. Green utilised a model developed in 2009 in order to ascertain the nature of sediment transportation and deposition within the Okura Estuary and Karepiro Bay.
- 2.8 Outputs from the model simulated sediment transportation under a limited range of environmental conditions (Calm and a moderate SW wind during 5, 25 and 100 year ARI rain events).
- 2.9 Outputs from the model have only taken in to account the proposed development by Okura Land Holdings Limited.
- 2.10 Sediment deposition results from the model were restricted to the Okura Estuary and did not present results detailing sedimentation within Karepiro Bay.
- 2.11 Results from the model presented in Dr. Green's evidence, and supporting documents, illustrate that the amount of sediment remaining in the system is dependent upon grainsize and environmental variables.
- 2.12 Typically the coarser sediment remains in the system and finer material is lost to the wider coastal environment. It was determined that the 15 micron sediment was closest to the profile of sediment being generated within the catchments.

Retention within the Okura Estuary of this sized material ranged from 25-75% depending on various environmental variables.

- 2.13 In general the deposition of sediment was restricted to the arms of the upper estuary or close to the point of discharge.

3 VALIDITY OF SEDIMENT TRANSPORTATION MODEL OUTPUTS

- 3.1 It is understood that during the development of the original sediment transportation model, calibration against water level measurements and suspended sediment concentrations was undertaken.
- 3.2 The model does not appear to account for the impact of waves generated within the estuary or entering the estuary. Waves and wave generated currents have the ability to re-suspend sediments leading to further mixing and changes in deposition patterns within a particular system.
- 3.3 Each model run simulates a ten day period around a specified storm event. It does not take into account multiple or concurrent storm events.
- 3.4 Further there appears to be no indication as to the potential change in annual sedimentation accumulation rates. This would provide a useful comparison for the assessment of potential effects over the medium to long term.
- 3.5 As noted above results have been presented for 5, 25 and 100 year ARI rain events under both calm conditions and a 15knot SW wind.
- 3.6 Of concern is the lack of an understanding around how the system might behave during wind events from either easterly or northerly quarters. Data contained within the original modelling report details the relative importance of easterly events at the location (refer **Exhibit A**).
- 3.7 In my experience events from the northerly and easterly quarters are drivers for significant rainfall along this stretch of coast.
- 3.8 For the reasons noted above I do not think that the conditions being simulated by the model in support of the proposed development are an accurate representation of real world scenarios.

4 POTENTIAL IMPACT OF INCREASED SEDIMENTATION

- 4.1 Analysis of aerial photo record has shown the expansion of mangrove communities within the Okura Estuary under existing conditions. It is recognised that as these communities become established they become more efficient at trapping sediment (**Exhibit B**)

- 4.2 It has been recognised that changes in land use that lead to sediment run off into estuary and harbour systems has contributed to an increase in mangrove area (De Luca, 2015). Extreme cases of accelerated mangrove colonisation can lead to an overall change in habitat type (Morgan, 2003).
- 4.3 Estuarine evolution models by authors such as Roy et al., 2001 describe the balance between geomorphic evolution and habitat distribution. In essence, as an estuary infills, habitats associated with the upper estuary expand further down the respective system. Further, as an estuary approaches its infill maturity it loses the potential to entrap sediment as there is less room for the material to settle, subsequently forcing additional sediment in to the adjacent coastal environment.
- 4.4 Swales et al., 2008 described the Okura Estuary as being at an advanced stage infilling indicated by the single tidal channel and extensive tidal flats. This would suggest that the system is sensitive to further increases in sediment inputs, thus the potential for increased rates of mangrove colonisation. In turn as the mangroves begin to colonise the intertidal flats of the upper estuary an increased amount of fine sediment can be expected to be delivered to the lower reaches of the estuary and adjacent coastal areas (i.e. Karepiro Bay).
- 4.5 On the ground this effectively means that Okura Estuary system is close to being infilled. As the system moves toward final stages of infilling I would expect to see increased mangrove colonisation west of the sandspit (the upper estuary) and in the sheltered arms of the system. Further, as the upper estuary infills there is less capacity for sediment deposition within the system. Subsequently more sediment is expected to be delivered to the adjacent coastal areas.

5 CONCLUSION

- 5.1 Modelling outputs of potential sediment deposition and transportation within the Okura Estuary are only representative of single rain events and provide little context around the potential changes in sediment accumulation rates.
- 5.2 Outputs from the model are restricted to certain environmental variables and are not considered to be a true representation of real world scenarios.
- 5.3 No other modelling information has been provided with respect to impact of other proposed developments in the catchment, hence ignoring potentially significant cumulative effects.
- 5.4 Other studies have recognised Karepiro Bay to be a sink for fine sediment derived from the Okura (and Weiti) catchments. The model outputs have not illustrated the level of sedimentation the proposed development will lead to in Karepiro Bay.
- 5.5 As such it is my view that the sediment transportation modelling information presented to date does not offer a reliable basis to assess effects on the Okura Estuary and the Marine Reserve.
- 5.6 It is understood that results from the sedimentation modelling have been used to ascertain the potential impact on the habitats of the Okura Estuary and Karepiro Bay.
- 5.7 Given the uncertainty around the potential medium to long term rates of sedimentation accumulation in both the Okura Estuary and Karepiro Bay it is my opinion that it is not possible to ascertain the potential impact on the respective habitats, based on the information available.
- 5.8 Due to the reasons given above, I do not support OHL's intensification proposals, and consider that if implemented to the extent and in the manner proposed, they do not guarantee that adverse effects on the Karepiro Bay, Okura Estuary and the Marine Reserve will be avoided.



Sam Morgan

Coastal Scientist

24 March 2016

References

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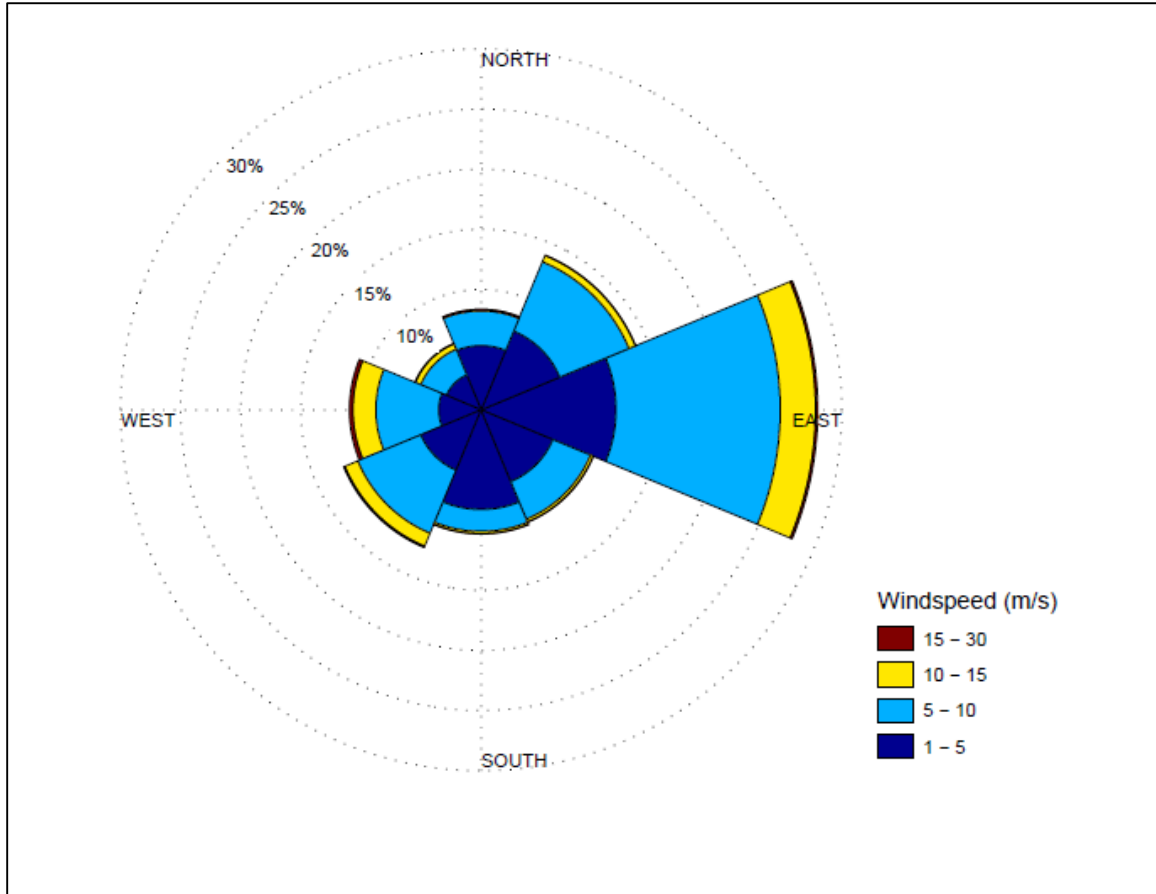
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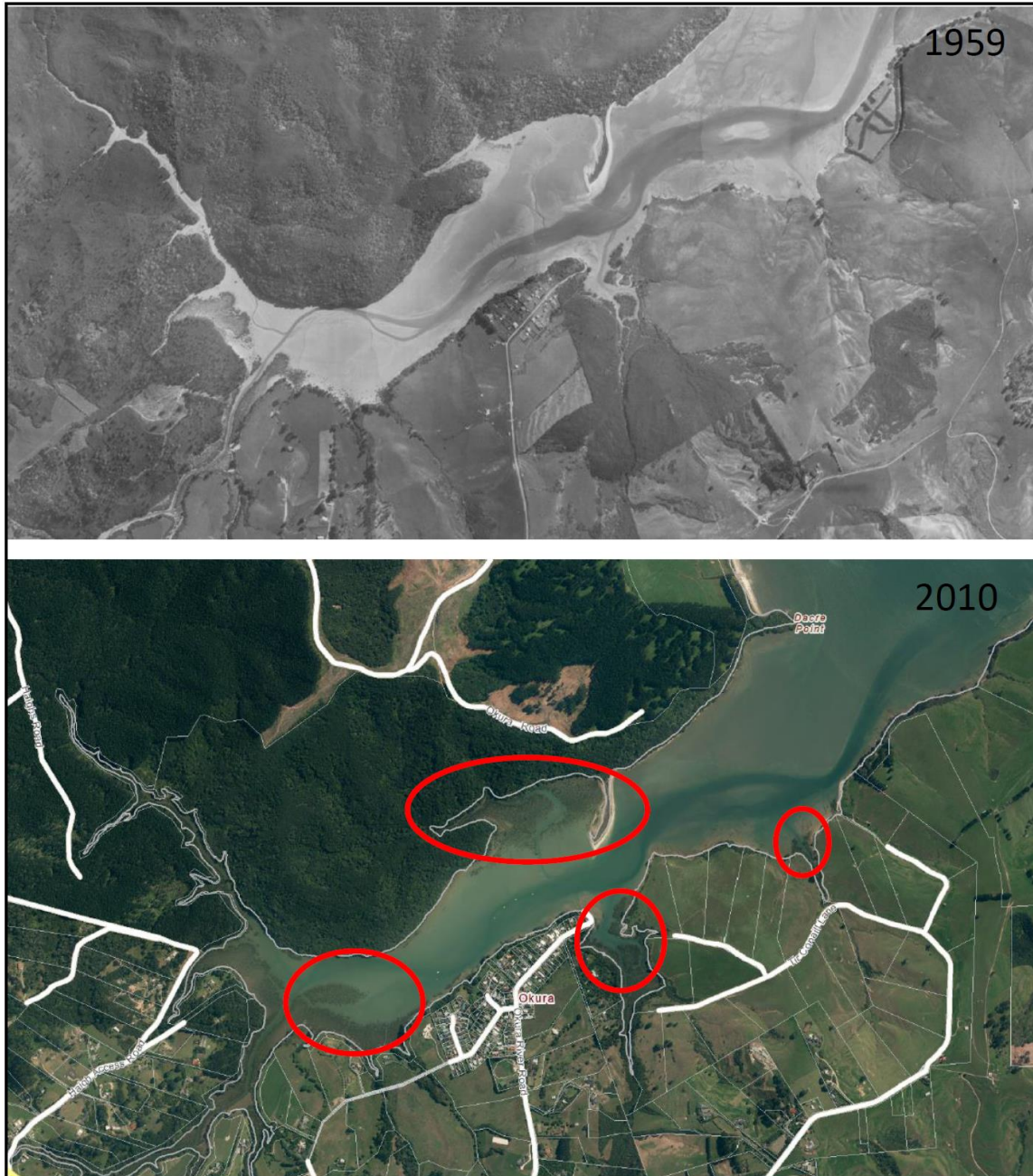
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EXHIBIT A



Wind rose describing wind speed and directional data recorded at Whangaparaoa between 1997 and 2009. (Taken from Pritchard et. al, 2009)

EXHIBIT B



Air photos of the Okura Estuary taken in 1959 and 2010. Red circles highlight areas of significant mangrove expansion.